

## CLAIMS

What is claimed is:

- 5        1.        A wiper apparatus comprising:  
             a wiper having a leading contact surface and a trailing contact surface, the  
             leading contact surface leads the trailing contact surface in a direction of wipe  
             during wiping; and  
             a capillary passageway in the wiper sized to allow capillary flow of a liquid  
10        along the capillary passageway by capillary forces.
2.        The wiper apparatus of claim 1 wherein the capillary passageway has  
             a length and a width, the length extending at least partially between the leading  
15        contact surface and the trailing contact surface and is greater than the width.
3.        The wiper apparatus of claim 2 wherein the length of the capillary  
             passageway is at least four times greater than the width of the capillary  
20        passageway.
4.        The wiper apparatus of claim 1 wherein the capillary passageway has  
             a width that is about 0.5 millimeters or less.  
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5.        The wiper apparatus of claim 1 wherein the capillary passageway  
             intersects at least one of the leading contact surface and the trailing contact  
             surface.  
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6.        The wiper apparatus of claim 1 wherein the capillary passageway  
             intersects the leading contact surface and the trailing contact surface.

7. The wiper apparatus of claim 1 wherein the capillary passageway has a constant width.

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8. The wiper apparatus of claim 1 wherein the length of the capillary passageway is oriented along an axis that is substantially parallel to the direction of wipe.

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9. A printer device comprising:  
a printhead having an nozzle plate;  
a wiper apparatus comprising:

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a wiper oriented to wipe the nozzle plate of the printhead, the wiper having a leading contact surface and a trailing contact surface, the leading contact surface leads the trailing contact surface in a direction of wipe during wiping; and

a capillary passageway formed in the wiper, sized to allow capillary flow of a liquid along the capillary passageway by capillary forces .

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10. The printer device of claim 9 wherein the capillary passageway has a length and a width, the length extending at least partially between the leading contact surface and the trailing contact surface and is greater than the width.

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11. The printer device of claim 10 wherein the length of the capillary passageway is at least four times greater than the width of the capillary passageway.

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12. The printer device of claim 9 wherein the capillary passageway has a width that is about 0.5 millimeters or less.

13. The printer device of claim 9 wherein the capillary passageway intersects at least one of the leading contact surface and the trailing contact surface.

14. The printer device of claim 9 wherein the capillary passageway intersects the leading contact surface and the trailing contact surface.

15. The wiper apparatus of claim 9 wherein the capillary passageway has a constant width.

16. The printer device of claim 9 wherein the length of the capillary passageway is oriented along an axis that is substantially parallel to the direction of wipe.

17. The printer device of claim 9 wherein:  
the printhead contains a first ink and a second ink;  
the nozzle plate has a first nozzle array to dispense the first ink and a second nozzle array to dispense the second ink; and  
the wiper is positioned such that, during wiping, the first tip of the wiper comes into contact with the first nozzle array and the second tip of the wiper comes into contact with the second nozzle array.

18. The printer device of claim 17 wherein the composition of the first ink is different than the composition of the second ink.

19. The printer device of claim 9 further comprising:

a second wiper oriented substantially parallel to the wiper, the second wiper having a second leading contact surface and a second trailing contact surface; and  
the second wiper having a second capillary passageway formed in the  
5 second wiper and having a second length that extends at least partially between the second leading contact surface and the second trailing contact surface, and a second width that is less than the second length.

10 20. The printer device of claim 19 wherein:

the printhead contains a first ink and a second ink, the second ink having a different composition than the first ink;

the nozzle plate has a first nozzle array to dispense the first ink and a second nozzle array to dispense the second ink; and

15 the wiper and second wiper are positioned relative to the nozzle plate of the printhead such that, during wiping, the first tip of the wiper and the third tip of the second wiper come into contact with the first nozzle array, the second tip of the wiper and the fourth tip of the second wiper come into contact with the second nozzle array, and the capillary passageway of the wiper and the second capillary  
20 passageway of the second wiper pass between the first nozzle array and the second nozzle array during wiping.

21. A printer device comprising:

25 a printhead that dispenses a first ink and a second ink through a nozzle plate, the second ink having a different composition than the first ink;

a wiper for wiping the nozzle plate of the printhead; and

a means for substantially preventing mixing of the first ink and the second ink on the nozzle plate during wiping.

22. The printer device of claim 21 wherein the means for substantially preventing mixing of the first ink and the second ink on the nozzle plate draws the first ink and the second ink away from the nozzle plate.

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23. The printer device of claim 22 wherein the means for substantially preventing mixing of the first ink and the second ink on the nozzle plate is a capillary passageway on the wiper.

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24. The printer device of claim 21 wherein:  
the nozzle plate has a first nozzle array to dispense the first ink and a second nozzle array to dispense the second ink;  
the means for substantially preventing mixing of the first ink and the second  
15 ink on the nozzle plate during wiping causes capillary flow of the first ink and the second ink between the first nozzle array and the second nozzle array.

25. A method for cleaning a printhead comprising:  
20 placing a wiper in contact with the printhead having a nozzle plate that dispenses a first ink and a second ink, the second ink having a different composition than the first ink;  
moving the wiper relative to the nozzle plate in a first direction of wipe; and  
drawing, by capillary action, the first ink and the second ink into a capillary  
25 passageway of the wiper.

26. The method of claim 25 further comprising:  
moving a first tip of the wiper across a first nozzle array of the nozzle plate;  
30 moving a second tip of the wiper across a second nozzle array of the nozzle plate; and  
moving the capillary passageway along the nozzle plate between the first nozzle array and the second nozzle array.

27. The method of claim 26 further comprising:  
moving the wiper relative to the nozzle plate in a second direction of wipe,  
that is opposite the first direction of wipe.

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28. A printer device comprising:  
a nozzle plate;  
a wiper apparatus for wiping the nozzle plate comprising:  
10 a wiper having a first tip and a second tip oriented at an angle with  
respect to one another, the first tip and the second tip being separated by an  
angle that is at least 180 degrees.

15 29. The printer device of claim 28 wherein:  
the wiper apparatus wipes the nozzle plate of the printhead along an axis in  
a direction of wipe;  
the first tip is oriented at a first angle relative to the axis, the first angle being  
greater than about 90 degrees and less than 180 degrees;  
20 the second tip is oriented at a second angle relative to the axis, the second  
angle being greater than about 90 degrees and less than about 180 degrees.

25 30. The printer device of claim 29 wherein:  
the first angle and the second angle are substantially equal.

31. The printer device of claim 28 wherein:  
the first tip is an integrated portion of a first wiper blade; and  
30 the second tip is an integrated portion of a second wiper blade, the second  
wiper blade being separate from the first wiper blade.

32. The printer device of claim 28 wherein the first tip and the second tip are integrated portions of one wiper blade of the wiper.

5           33. The printer device of claim 28 wherein:  
the printhead comprises a nozzle plate that dispenses a first ink and a  
second ink, the second ink being distinct from the first ink;  
the nozzle plate comprises a first nozzle array to dispense the first ink and a  
second nozzle array to dispense the second ink; and  
10           the wiper is positioned relative to the nozzle plate such that, during wiping,  
the first tip of the wiper comes into contact with the first nozzle array and the  
second tip of the wiper comes into contact with the second nozzle array.

15           34. The printer device of claim 28 further comprising:  
a second wiper having a third tip and a fourth tip; and  
the third tip and the fourth tip are oriented at an angle with respect to one  
another.

20           35. The printer device of claim 34 wherein:  
the wiper apparatus wipes the nozzle plate of the printhead along an axis in  
a direction of wipe;  
the third tip is oriented at a third angle relative to the axis, the third angle  
25           being greater than about 90 degrees and less than about 180 degrees;  
the fourth tip is oriented at a fourth angle relative to the axis, the fourth angle  
being greater than about 90 degrees and less than about 180 degrees.

30           36. The printer device of claim 34 wherein:  
the wiper and the second wiper are substantially parallel to each other, the  
first tip being substantially parallel to the third tip and the second tip being  
substantially parallel to the fourth tip.

37. A printer device comprising:  
a printhead having an nozzle plate;  
5 the nozzle plate having a first nozzle array that dispenses a first ink and a second nozzle array that dispenses a second ink, the first ink being a different composition than the second ink;  
a wiper apparatus for cleaning the nozzle plate comprising:  
a means for wiping the first ink and the second ink in divergent  
10 directions relative to a direction of wipe.
38. A method for cleaning a printhead comprising:  
placing a wiper having a first tip oriented along a first axis and a second tip  
15 oriented along a second axis in contact with a nozzle plate which dispenses a first ink through a first nozzle array and a second ink through a second nozzle array;  
moving the wiper relative to the nozzle plate in a direction of wipe; and  
wiping the first nozzle array with the first tip in a first direction substantially perpendicular to the first axis and wiping the second nozzle array with the second  
20 tip in a second direction substantially perpendicular to the second axis, the first axis and the second axis being distinct from one another.
39. The method of claim 38 further comprising:  
25 moving a first tip of the wiper across a first nozzle array of the nozzle plate and moving a second tip of the wiper across a second nozzle array of the nozzle plate.
- 30 40. A printer device comprising:  
a nozzle plate having a first nozzle array to dispense a first ink and a second nozzle array to dispense a second ink, the second ink being distinct from the first ink; and



a wiper apparatus comprising:

a first wiper oriented along a first axis, the first wiper contacting the first nozzle array without contacting the second nozzle array during wiping; and

5 a second wiper oriented along a second axis, the second wiper contacting the second nozzle array without contacting the first nozzle array during wiping.

10 41. The printer device of claim 40 wherein:  
the first wiper and the second wiper are substantially parallel to one another and are substantially perpendicular to the direction of wipe.

15 42. The printer device of claim 40 wherein:  
the first wiper is oriented at a first angle relative to the direction of wipe;  
the second wiper is oriented at a second angle relative to the direction of wipe.

20 43. The printer device of claim 40 further comprising:  
a third wiper oriented along a third axis, the third wiper contacting the first nozzle array without contacting the second nozzle array during wiping; and  
a fourth wiper oriented along a fourth axis, the fourth wiper contacting the  
25 second nozzle array without contacting the first nozzle array during wiping.

44. The printer device of claim 43 wherein the third wiper is substantially  
parallel to the first wiper and the fourth wiper is substantially parallel to the second  
30 wiper.

45. A printer device comprising:

a nozzle plate having a first nozzle array that dispenses a first ink and a second nozzle array that dispenses the second ink, the first ink being a different composition than the second ink; and

5 a wiper apparatus comprising a means for consecutively wiping the first nozzle array and the second nozzle array.

46. A method for cleaning a printhead comprising:

10 placing a wiper in contact with a nozzle plate of the printhead, the nozzle plate having a first nozzle array that dispenses a first ink and a second nozzle array that dispenses a second ink, the second ink being distinct from the first ink;

placing a first wiper in contact with nozzles of the first nozzle array oriented along a first axis;

15 placing a second wiper in contact with nozzles of the second nozzle array oriented along a second axis, the second axis being distinct from the first axis;  
moving the wiper apparatus relative to the nozzle plate in a direction of wipe.

20 47. A wiper apparatus comprising:

a wiper head comprising:

a first pair of wiper tips and a second pair of wiper tips for wiping a nozzle plate of the printhead; and

25 the first pair of wiper tips lie in a first plane and the second pair of wiper tips lie in a second plane, the first plane intersecting the second plane.

48. The wiper apparatus of claim 47 wherein:

30 the first pair of wiper tips comprises a first tip and a second tip oriented at first angle with respect to each other; and

the second pair of wiper tips comprises a third tip and a fourth tip oriented at a second angle with respect to each other.

49. The wiper apparatus of claim 47 wherein:  
the first pair of wiper tips contacts the second pair of wiper tips, the first tip  
contacting the third tip and the second tip contacting the fourth tip.

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50. The wiper apparatus of claim 49 wherein:  
the first angle between the first tip and the second tip is substantially equal to  
the second angle between the third tip and the fourth tip.

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51. The wiper apparatus of claim 49 wherein:  
the first angle between the first tip and the second tip ranges from about 45  
degrees to about 150 degrees; and  
the second angle between the first tip and the second tip ranges from about  
45 degrees to about 150 degrees.

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52. The wiper apparatus of claim 49 wherein:  
a cross-section intersecting the first tip, the second tip, the third tip and the  
fourth tip is a tetragon.

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53. The wiper apparatus of claim 47 further comprising:  
a flexible stem that supports the wiper head; and  
a wiper base that supports the stem and the wiper head.

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54. The wiper apparatus of claim 53 wherein the wiper base is movable in  
two directions.

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55. A printer device comprising:

a printhead which contains a first ink and a second ink, the second ink having a different composition than the first ink;

the printhead comprises a nozzle plate that has a first nozzle array to  
5 dispense the first ink and a second nozzle array to dispense the second ink;

a wiper apparatus for cleaning the printhead comprising:

a wiper head comprising:

a first pair of wiper tips oriented at a first angle with respect to one  
another and a second pair of wiper tips oriented at a second angle with  
10 respect to one another;

the first pair of wiper tips are positioned in a first plane and the second  
pair of wiper tips are positioned in a second plane, the first plane intersecting  
the second plane;

the wiper head is positioned relative to the nozzle plate of the printhead such  
15 that, during wiping in a first direction, the first tip and the second tip come into  
contact with the first nozzle array and the second nozzle array, respectively; and

the wiper head is positioned relative to the nozzle plate of the printhead such  
that, during wiping in a second direction, opposite the first direction, the third tip and  
the fourth tip come into contact with the first array of nozzles and the second array  
20 of nozzles, respectively.

56. A printer device comprising:

a printhead which contains a first ink and a second ink, the second ink  
25 having a different composition than the first ink;

the printhead comprises a nozzle plate that has a first nozzle array to  
dispense the first ink and a second nozzle array to dispense the second ink;

a wiper apparatus for cleaning the printhead comprising:

a wiper head movable in a first direction of wipe and a second  
30 direction of wipe, the first direction of wipe and second direction of wipe  
being opposite one another; and

a means for wiping the first ink and the second ink in divergent  
directions relative to the first direction of wipe and the second direction of wipe.

57. The printer device of claim 56 wherein the means for wiping the first ink and the second ink in divergent directions comprises a first pair of wiper tips oriented at a first angle relative to one another, and a second pair of wiper tips oriented at a second angle with respect to one another, and the first pair of tips lie in a first plane and a second pair of tips lie in a second plane, the first plane intersecting the second plane.

58. A method for cleaning a printhead comprising:  
placing a first pair of wiper tips oriented at a first angle with respect to one another in contact with a nozzle plate having a first nozzle array that dispenses a first ink and a second nozzle array that dispenses a second ink, the second ink being distinct from the first ink;  
moving the wiper apparatus relative to the nozzle plate in a first direction of wipe;  
placing a second pair of wiper tips oriented at a second angle with respect to one another in contact with the nozzle plate;  
moving the wiper apparatus relative to the nozzle plate in a second direction of wipe.